



Materials Engineering Branch

TIP*



No. 021 Problems with Pure Tin Coatings

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In applications that require pure tin coatings, one needs to be aware of potential problems such as whisker growth and tin “pest”. When unalloyed, pure tin plating is subject to a transformation of crystal structure. At temperatures below +50°F the normal cubic crystal form of pure tin can transform to the tetragonal form and the probability of transformation increases as the temperature drops with a maximum at about -40°F.

When the transformation occurs, there is an increase in the volume of the crystal structure that causes the tin-plating to crack and spall off the substrate. This phenomenon is called "tin pest" or "tin disease.” Alloying the tin with small amounts of such elements as lead, bismuth or antimony can prevent this problem. Current practice is to replace pure tin plating with tin-lead plating.

Another problem with tin plating that has a high level of residual stress is that of tin whisker growth. Such whiskers can grow in air as well as in vacuum, as long as the driving stress field is available, and they can cause shorting problems. To prevent this problem, electrodeposited tin plating should be re-flowed (fused) to reduce the residual stress level.

The following GSFC web site (Code 562) is an excellent source of information on whisker growth: <http://nepp.nasa.gov/whisker/index.html>.

Figures 1 and 2, on the following page, are electron micrographs of tin whisker growth.

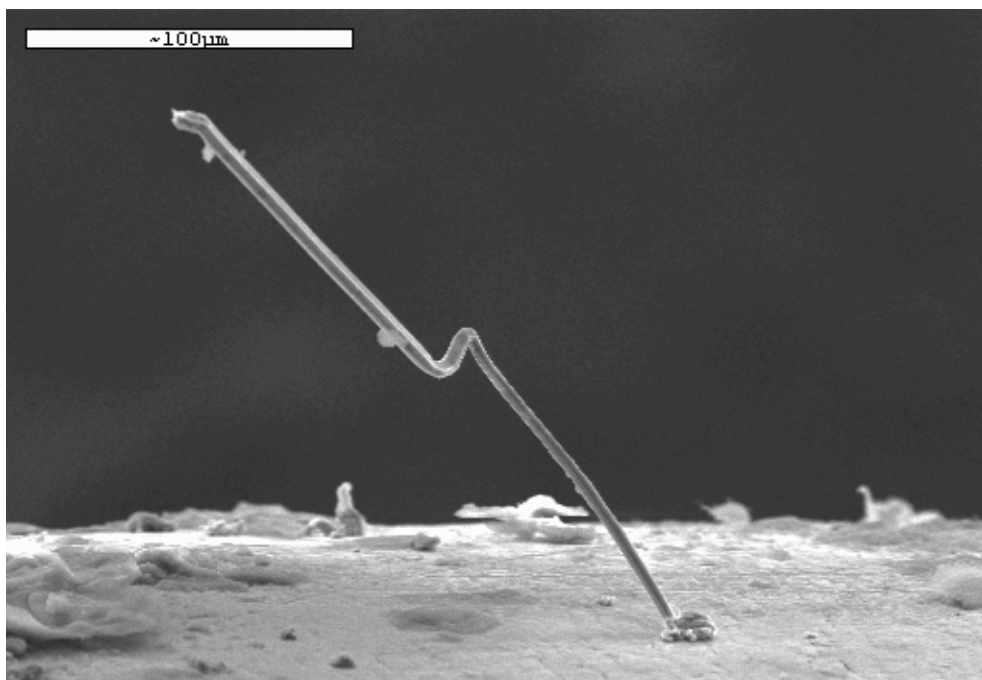


Figure 1. Example of a tin whisker. ($\approx 430\times$ magnification)

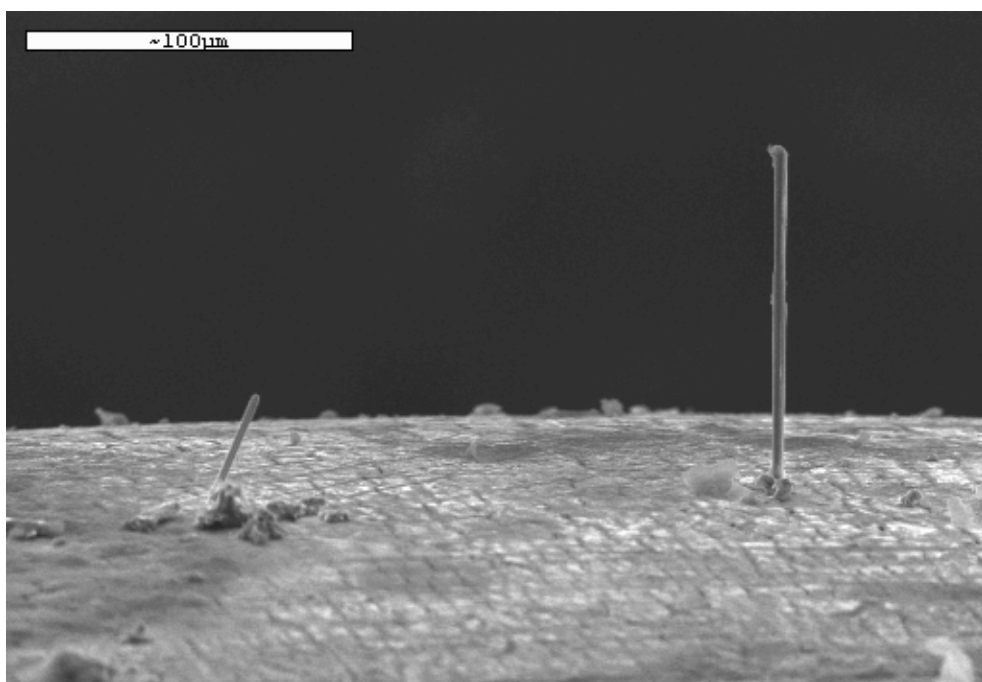


Figure 2. Example of a tin whisker. ($\approx 430\times$ magnification)